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Soil Survey
of
Delaware County, New York

By

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Bureau of Chemistry and Soils

In cooperation with the
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SOIL SURVEY

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By CLARENCE LOUNSBURY, United States Department of Agriculture, in Charge, and P. D. BEERS, F. B. HOWE, E. E. WAITE, C. S. PEARSON, and C. H. DIEBOLD, Cornell University Agricultural Experiment Station

COUNTY SURVEYED

Delaware County, N. Y., is situated toward the southeastern part of the State. (Fig. 1.) It is roughly rectangular and from the southwestern part, which borders Pennsylvania, it extends northeastward into the foothills of the Catskills. The county has an approximate length of 48 miles and a breadth of about 30 miles. Its area is 1,449 square miles, or 927,360 acres.

Physiographically, the region of which Delaware County is a part is a deeply dissected plateau sloping from an elevation of about 3,000 feet above sea level in the eastern part of the county to somewhat less than 2,000 feet in the western part. Before dissection, the region presumably constituted a smooth southwestward-sloping plain or plateau. The details of relief at present are due to differences in depth and thoroughness of dissection, width of valleys, and character of valley slopes. The maximum depth of dissection is measured by the difference in elevation between the valley floor of Delaware River in the southwestern part of the county, 840 feet above sea level, and that of the high part of the plateau, a little more than 3,000 feet. The highest point in the county, 3,448 feet above sea level, is Roundtop Mountain, in the eastern part.

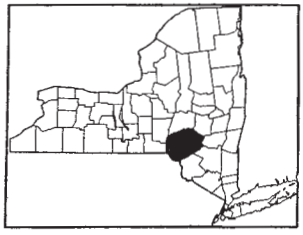

FIGURE 1.—Sketch map showing location of Delaware County, N.Y.

All the valleys are narrow, the true river flood plains in few places attaining a width of one-half mile and in most places along the larger streams being about one-quarter mile.

The elevation of the ridge tops, or the height of the county as it would be if the valleys, broad and narrow, were all filled to ridge-top level, in the western and northwestern parts of the county is about 2,000 feet. This may be considered the upland plain or dissected plain of the county as it is in its present condition. Very few areas in these parts of the county are higher than this, and those that are higher are small. Eastward and southeastward, however, ridges and hills higher than this level occur and increase eastward both in number and in area covered by each.

In the extreme eastern part of the county, especially the southeastern part, these higher areas, consisting mainly of watershed ridges, constitute the greater part of the area covered; the lower level, corresponding to the 2,000-foot plain of the northwestern part of the county, consisting of shoulders along valley sides, smooth

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covelike areas around the heads of valleys, and here and there larger somewhat isolated areas at or near the 2,000-foot level.

Thus the fundamental or dominant feature in the relief of the county is a plain, now dissected, lying at an elevation of about 2,000 feet—a little less than that in the western part and slightly more in the eastern part. This plain is continuous, except for the complete dissection by streams in the western and northwestern parts of the county, and in the eastern part it is interrupted by hills and ridges standing on it, which gradually increase in numbers eastward and southeastward to such an extent that in considerable areas of this part of the county the "interruptions" occupy most of the area, the plain being limited to shoulders on valley sides, smooth high areas around the heads of valleys, and small isolated areas.

The whole county originally was forested, largely with deciduous hardwoods. Some fair-sized stands of white pine and hemlock occurred, but the dominant growth consisted of hard maple, red oak, white oak, beech, ash, birch, ironwood, and chestnut. All the chestnut has practically succumbed to blight, and the hardwoods are the predominant species at the present time. Nearly half the area of the county, to a large extent the areas less suitable for cultivation, still remains in forest.

Settlements were made in a few places prior to the American Revolution, but the substantial settlement occurred immediately following that period. Most of the settlers were from New England or from older-settled parts of the State. Many were native Scotch or of Scotch descent. The county was organized in 1797, and since 1820 has retained its present form. The population, according to the 1930 census, is 41,163, of which 37,667 are classed as rural. Of the rural population, 17,684 are classed as rural-farm population, and 19,983 as rural-nonfarm population.

Delhi, the county seat, with a population of 1,840, is situated in the east-central part of the county. Walton, in the west-central part, with a population of 3,496, is the largest town. Important smaller towns include Hancock, Sidney, Stamford, Roxbury, Margaretville, and Downsville, all of which are local trading and shipping points. Walton is about 180 miles by rail from New York City.

Two railroads, the Erie and the New York, Ontario & Western, afford direct communication with New York City. Two others, the Delaware & Hudson, in the northwestern part, and the West Shore, traversing the eastern part of the county, do considerable business. Several lines of paved or hard-surfaced roads connect the principal towns, and the Liberty Highway passes through the southwestern part of the county. Most of the dirt roads are maintained in good condition during the greater part of the year. Good church and school facilities are provided, and some of the schools are on a centralized basis. Telephones and rural mail delivery service cover practically all the county.

The manufacture of commercial products is carried on at some of the larger towns. In past years, wood alcohol, which utilized some of the forest products, was manufactured in a number of places, but at present only two or three of the plants are in operation. For many years quarrying of flagstones for walks, curbing, and other uses has been of some importance. Lumbering is no longer important, though some lumber, railroad ties, pulpwood, and piling, are cut from the second-growth trees.

CLIMATE

The climate of Delaware County is similar to that prevailing elsewhere in southern New York. It is characterized by a rather wide range in temperature between the summer and winter seasons. The summers are mild and short, with occasional periods of extreme heat and fairly high humidity. The winters are usually cold, and heavy snowfalls occur at times. The severe part of winter usually lasts from December to March, inclusive, and snowfalls may prevail throughout this period. During some winters little snow falls and mild temperature prevails, but rarely is this season so open that outdoor farm work can be performed. Snow has been reported as early as November and as late as May.

The difference between the mean winter and mean summer temperatures is about 42° F.

Differences in elevation result in no great climatic differences, though the higher elevations in the eastern part of the county are somewhat colder and snow remains a little longer than on the lower-lying lands of the valleys. In some years land in the valleys can be worked from 10 to 15 days earlier in the spring than can land on the higher elevations. The average frost-free period is 120 days, from May 25 to September 22, as shown by the United States Weather Bureau records at South Kortright. For most crops a safe growing season is somewhat longer than this, especially on hill locations. Killing frost has occurred as early as September 6 and as late as June 11.

Rainfall is very evenly distributed throughout the year, and the amount is ordinarily sufficient to provide for normal crop growth. In occasional years there may be abnormal or deficient rainfall, though practically neither condition is sufficient to cause crop failure. The heaviest rainfall usually occurs during the summer months. The average annual precipitation is about 40 inches. The winter snowfall, which averages about 60 inches, is usually sufficiently continuous to protect grass and fall-seeded crops from destructive heaving.

The prevailing winds blow from the west or northwest and are more frequent during late winter and early spring. Tornadoes or destructive winds are rare.

Much more cloudy weather occurs during the winter than during the summer. Probably from 65 to 70 per cent of the summer days are sunshiny.

Tables 1 and 2 give the more important climatic data for Delaware County as recorded by the United States Weather Bureau stations at South Kortright and at Delhi.

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at South Kortright, Delaware County, N. Y.*

[Elevation, 1,527 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1900)	Total amount for the wettest year (1902)	Snow, average depth
	°F.	°F.	°F.	*Inches*	*Inches*	*Inches*	*Inches*
December	25.4	62	−21	2.98	2.06	4.11	18.3
January	22.0	65	−36	2.28	1.91	1.61	11.4
February	20.9	70	−30	2.32	3.55	3.56	14.6
Winter	22.8	70	−36	7.58	7.52	9.28	44.3
March	30.2	79	−20	2.73	2.31	3.28	7.5
April	42.5	86	5	2.37	1.71	3.30	2.2
May	54.7	89	15	3.66	1.66	2.48	(1)
Spring	42.5	89	−20	8.76	5.68	9.06	9.7
June	63.2	92	31	4.19	4.74	8.41	0
July	66.2	98	32	4.27	2.84	6.39	0
August	64.1	93	30	4.59	3.18	3.55	0
Summer	64.5	98	30	13.05	10.76	18.35	0
September	58.1	88	21	3.65	2.50	5.24	0
October	46.2	84	14	3.38	2.09	5.14	.5
November	35.3	69	−5	2.54	2.37	.81	6.1
Fall	46.5	88	−5	9.57	6.96	11.19	6.6
Year	44.1	98	−36	38.96	30.92	47.88	60.6

[1] Trace.

TABLE 2.—*Normal monthly, seasonal, and annual temperature and precipitation at Delhi, Delaware County, N. Y.*

[Elevation, 1,460 feet]

Month	Temperature			Precipitation, mean	Month	Temperature			Precipitation, mean
	Mean	Absolute maximum	Absolute minimum			Mean	Absolute maximum	Absolute minimum	
	°F.	°F.	°F.	*Inches*		°F.	°F.	°F.	*Inches*
December	26.0	58	−14	2.78	June	63.2	92	29	4.35
January	22.6	50	−26	2.54	July	68.2	93	40	5.27
February	22.2	58	−16	2.44	August	66.2	89	34	4.41
Winter	23.6	58	−26	7.76	Summer	65.9	93	29	14.03
March	33.6	70	−15	3.04	September	60.7	87	27	3.77
April	44.7	75	14	3.21	October	49.6	82	4	3.62
May	54.9	82	21	3.49	November	37.5	65	−2	2.83
Spring	44.4	82	−15	9.74	Fall	49.3	87	−2	10.22
					Year	45.8	93	−26	41.75

AGRICULTURE

Agriculture in Delaware County began with the entry of permanent settlers during the decade following the close of the Revolutionary War. Like pioneer agriculture elsewhere, it was simple and consisted largely of producing subsistence crops for the home. Farming was carried on in connection with lumbering, and later, as the virgin-timber stands became exhausted, farming received chief attention. During this early period the leading crops grown were corn, oats, rye,

wheat, buckwheat, and potatoes. Livestock raising and maple-sugar production were important industries in the early days, and they still hold a prominent place in many counties of the State. Potatoes never were an important commercial crop, but they continue to hold a place as a subsistence crop. In the decades immediately preceding and following the Civil War, some hops were grown, but their production gradually declined, and in late years none have been produced. As farming progressed, dairying gradually assumed importance, the products consisting largely of butter and cheese. The 1850 census reports a production of 3,780,585 pounds of butter in 1849. This gradually increased to 9,590,349 pounds in 1889. In 1849, 89,038 pounds of cheese were made, but this product declined with the increased production of butter. Following 1889, in order to help satisfy the requirements of New York City for milk, increasing quantities of milk were marketed and the production of butter and cheese correspondingly declined.

The more important field crops maintained about the same acreage and yield for several decades until about 1920, since which time the acreages of most field crops have declined.

Table 3 gives the acreages and yields of leading field crops as reported by the Federal census for the years 1899 to 1929, inclusive.

TABLE 3.—*Acreage and yield of principal crops in Delaware County, N. Y., in stated years*

Crop	1899		1909		1919		1929	
Corn:	*Acres*	*Bushels*	*Acres*	*Bushels*	*Acres*	*Bushels*	*Acres*	*Bushels*
Grain	4,600	139,340	1,420	45,780	1,106	55,209	87	3,740
								Tons
Silage							3,996	44,772
Fodder							858	
Hogged off							607	
								Bushels
Oats	21,587	718,020	12,980	337,938	13,544	405,562	4,243	123,982
Wheat	71	1,040	12	220	361	5,059	35	619
Rye	520	5,270	254	3,609	227	3,228	14	183
Barley	187	5,370	131	3,140	127	2,967	68	671
Buckwheat	7,366	128,210	7,191	132,284	5,443	99,941	948	17,008
Potatoes	4,590	427,579	4,331	479,061	3,891	369,960	1,883	156,518
		Tons		*Tons*		*Tons*		*Tons*
Hay							162,762	223,951
Timothy			12,950	15,478	11,012	15,192		
Timothy and clover			127,029	153,992	123,255	167,836	118,439	172,959
Clover	264	401	432	644	959	11,822	2,454	4,950
Alfalfa			39	79	45	113	953	2,025
Other tame hay	158,747	185,627	20,092	21,515	20,559	23,591	36,032	35,042
Wild hay	13	14	639	497	1,840	2,012	355	362
Small grains cut green	1,477	2,539	2,772	4,881	4,111	7,931	4,174	8,168
Annual legumes							355	445
	Trees	*Pounds*	*Trees*	*Pounds*	*Trees*	*Pounds*	*Trees*	*Pounds*
Maple sugar		170,040	325,831	134,288	374,314	65,621		14,495
		Gallons		*Gallons*		*Gallons*		*Gallons*
Maple sirup		31,802		68,958		99,143		36,388
		Bushels		*Bushels*		*Bushels*		*Bushels*
Apples	247,026	463,207	190,896	350,229	151,051	182,664	86,123	72,546
Peaches	369	315	89	32	68	17	175	135
Pears			8,024	6,971	6,706	3,851	3,542	1,582
	Vines	*Pounds*	*Vines*	*Pounds*	*Vines*	*Pounds*	*Vines*	*Pounds*
Grapes	4,295	33,800	1,295	30,666	1,433	12,711	533	2,882

The hay crop is not so important as formerly. It consists mainly of timothy and clover with some redtop, other cultivated grasses, and many mowings having a rather high proportion of volunteer grasses and weeds.

Silage corn is more important than corn for grain. It occupied almost 84 per cent of the total corn acreage in 1929.

The chief money returns on farms are from dairy products which have increased in value from $268,445 in 1899 to $9,651,057 in 1929. The poultry industry likewise has increased in importance. In 1899 poultry was valued at $99,222. In 1909 poultry and eggs represented a total value of $529,376, and in 1929 they were worth $1,451,078. In the last few years the alfalfa acreage has increased, 953 acres being devoted to the crop in 1929. Vegetables valued at $253,913 were grown for sale in 1929, chief among which was cauliflower valued at $202,686.

Tables 4 and 5 give the values of different farm products by classes in 1929, and the number and value of animals on farms, April 1, 1930, respectively.

TABLE 4.—*Value of agricultural products in Delaware County, N. Y., in 1929*

Crop	Value	Livestock and products	Value
Cereals	$102,419	Domestic animals	$9,924,601
Other grains and seeds	668	Dairy products, excluding home use	9,651,057
Hay and forage	2,920,072	Poultry and eggs	1,451,078
Vegetables	437,080	Wool	6,188
Fruits and nuts	112,858		
All other crops	72,935	Total	21,032,924
		Total agricultural products	24,728,956
Total	3,696,032		

TABLE 5.—*Number and value of domestic animals on the farms of Delaware County, N. Y., April 1, 1930*

Animals	Number	Value	Animals	Number	Value
Horses	8,239	$1,048,629	Goats	84	$604
Mules	132	15,438	Swine	3,434	48,825
Asses and burros	4	320	Chickens	275,675	314,270
Cattle	109,070	8,774,760	Other poultry	11,089	30,458
Sheep	3,850	36,025			

Commercial fertilizers are used regularly by most farmers and are generally considered profitable. Efficient use is generally made of stable manure. The 1930 census reports an expenditure of $150,857 in 1929 for fertilizers which were used on 53.9 per cent of the farms. Most of the fertilizers are bought ready mixed. The use of lime is considered desirable and profitable especially in obtaining stands of leguminous crops. Ground limestone and some hydrated lime are used.

Much of the farm labor is done by the farmer and his family. However, on 63.3 per cent of the farms of the county hired labor is used. A total expenditure of $1,023,882 was made for labor in 1929, or an average of $408.57 for the 2,506 farms reporting. Most of the laborers are native white, and at present the supply is sufficient to meet the demand. In this county, where dairy farms prevail, much

labor is used throughout the year, and most laborers are engaged on a monthly or a yearly basis. Monthly wages range from $30 to $50, including board. Married men are usually furnished a house, fuel, milk, garden plot, and other facilities in addition. Day help is employed more often during busy seasons, and day wages range from $2 to $3.

Owing to the requirements of the dairy industry and the availability of rugged land, farms are somewhat larger than those in smoother parts of the country. Most of them range in size from 75 to 250 acres. Since 1880 the average size of farms has gradually increased from 140 to 171.5 acres. The increase in size has been accompanied by a corresponding decrease in the number of farms.

Of the average farm, about 28 per cent of the land is cultivated or crop land; 52.7 per cent pasture land, of which nearly 30 per cent is potentially arable; and the remainder, reserved woodland or land otherwise utilized.

The 1930 census reports 90.8 per cent of the farms operated by owners, 7.1 per cent by tenants, and 2.1 per cent by managers. Between 1900 and 1925 there was a gradual increase in owner-operated farms from 87.3 to 92 per cent. Lately this tendency has slightly reversed. The terms of tenancy seem about equally divided between cash and share rentals. On the cash basis, the terms vary somewhat, but if the owner furnishes the dairy herd, the terms are about $15 a cow a year. Share rentals are usually on a half basis, the details varying with the farm improvements, proximity to markets, and the kind and number of livestock kept.

The usual well-ordered dairy farm has buildings and equipment well suited for the business. Most of the barns are well constructed and have ample space to house the cattle and other livestock properly, in addition to storage space for hay and other feed. Silos, although not universal, are part of the equipment on most of the better farms. Power milkers and farm water systems are in general use.

The better types of field machinery are used on the better-organized farms. These include tractors, with the adapted plowing and pulverizing equipment, hay and other harvesting machines, and motor trucks.

Very little farm land has changed hands recently, largely owing to the depressed agricultural conditions throughout the country during the last few years. According to local statements many well-located farms, with a large proportion of tillable land and equipped with good buildings, may be purchased at very reasonable prices. Other less well located lands more distant from markets are valued correspondingly lower. The value of most of the rougher, forested lands is governed by the timber values. The average value of farm land at present (1930), including buildings is about $39 an acre, and the average assessed value of land alone is $14.23 an acre.

As dairying is the chief type of farming in the county, attention is largely centered on this industry. Several breeds of cattle are raised, depending on the preference of the individual farmer. Holstein-Friesians lead, and many Ayrshires, Guernseys, and Jerseys are kept. Many cattle are purebred and registered, and there are many good grade cows. Practically all sires of the better herds are purebred.

Much interest is taken in the maintenance of high milk production and in the improvement of herds with this object in view. A number

of dairy herd-improvement associations are organized throughout the county. Examination of cattle for tuberculosis and the elimination of diseased individuals has been practiced for some time, and this has resulted in many accredited herds.

A large proportion of the cattle are home-bred or obtained locally. Some cattle, especially sires, are purchased outside the county.

The greater part of the milk produced is shipped daily from more than 50 shipping points to help supply the metropolitan area of New York City. Some cream is shipped. Manufactories throughout the county use a large quantity of milk to make creamery butter, condensed milk, powdered whole milk, powdered skim milk, powdered buttermilk, cottage cheese, pot cheese, baker's cheese, and ice cream. A small local trade in market milk and cream is maintained in several of the larger towns of the county.

Farm animals other than cattle are comparatively unimportant. A few sheep are raised, especially on some of the larger farms which have ample pasture areas. Most of the sheep are of the Shropshire and Southdown types. Swine are raised on most farms to consume feed by-products, and the pork provides part of the home meat supply. Some surplus is marketed locally or through buyers. The principal breeds of hogs are Chester White, Duroc-Jersey, and Poland China.

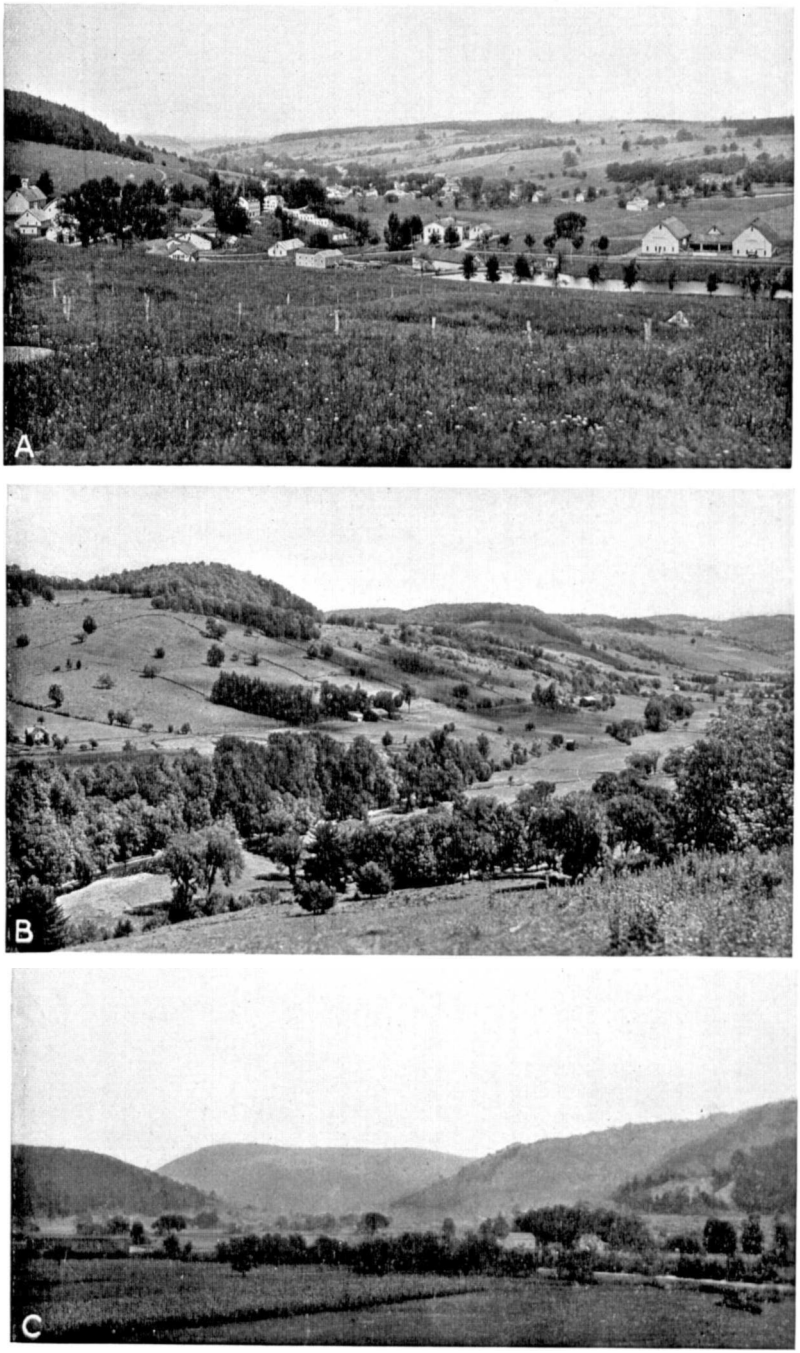
Poultry is raised on practically all farms, though not many farmers specialize to a marked extent. Chickens and eggs provide a reliable income on many farms. White Leghorn, Plymouth Rock, and Rhode Island Red are the leading breeds. Some turkeys, ducks, and geese are raised.

The field crops grown are primarily intended for the maintenance of the dairy industry and are selected with this end in view. The production of corn for grain has declined, and the corn now produced is used mostly for silage and dry fodder. Small acreages of oats are grown on practically every farm, and the grain is used largely as feed for horses. Buckwheat is grown occasionally as a cash crop. Sufficient hay, consisting of timothy, clover, and some alfalfa, is produced to meet the farm requirements. Additional forage crops include German millet, Sudan grass, and soybeans. Concentrated feeds for cattle are purchased for the most part through local dealers.

The most important special cash crop produced is cauliflower, the production of which is confined mainly to three localities—Margaretville and vicinity, Little Delaware Valley, and the vicinity of Hamden. Soils in these sections are sufficiently productive for the purpose and capable of improvement, and the atmosphere is cool and moist, which is favorable for the growth of the crop. The acreage varies somewhat from year to year. In 1929, 350 acres were devoted to cauliflower.

The general cropping scheme consists in growing corn (largely for silage); oats; hay, including timothy, clovers, and some alfalfa and millet; and small acreages of potatoes. No hard and fast systems of rotation seem to prevail, though it is common practice to plant corn on plowed sod land, which is followed by oats the next year. Seeding with timothy and clover accompanies or immediately follows the oats seeding.

Land for corn may be plowed in the fall, if time be available, or as early in the spring as the season allows. Fall-plowed land has the advantage of freezing and thawing, resulting in more even bedding of



A, View along West Branch Delaware River, near Delhi. Walton soils on lower valley slopes, Lackawanna silt loam on higher levels, and Lackawanna stony silt loam on highest forested areas. B, Farmstead near Delhi. Lackawanna silt loam on hill at left. C, Characteristic relief along East Branch Delaware River, near Downsville. Barbour soils in foreground, rough stony land and Culvers stony silt loam on hills

the soil than when it is spring plowed. In the fall, incorporation of organic matter is more thorough and many hibernating insect pests are destroyed. Land to be prepared for oats is fall plowed when possible. Spring preparation of plowed land consists of thorough harrowing and in many places of disking. Oats are sown early in May or late April, if possible, and corn planting follows later in May. Planting of crops is ordinarily somewhat earlier in the valleys, where the snow melts somewhat early in the spring and where many of the soils have free subsoil drainage, than is possible on the uplands which hold snow longer and where the dense subsoils do not allow excess moisture to escape so readily.

Oats usually mature by August 15, following the haying season. Silage corn is harvested, if possible, just before killing frosts may be expected, generally about the middle of September.

The use of lime is recognized as important in maintaining the soil in a satisfactory state of productivity, especially in insuring success with clovers and other legumes. From 1,500 to 2,000 pounds of ground limestone are generally applied once in a crop rotation, usually at the time of preparation of land for oats. Applications ranging from 1 to 2 tons are used, depending on previous soil treatment and the probable degree of soil acidity. All available stable manure is used, a large part being applied to sod land to be plowed, and some farmers reserve a supply in compost heaps to be used as a top-dressing on grass and other crops.

It is common practice to use commercial fertilizers with planted crops. This may be a complete fertilizer or superphosphate (acid phosphate) alone. Some farmers think that results are as satisfactory with superphosphate as with complete fertilizers, especially if ample quantities of stable manure have been used.

The soils of the county are not naturally well supplied with organic matter, but under consistent crop treatment and the application of manure from dairy herds and other farm animals, the fertility of the better-developed soils can be maintained and improved. The reddish soils, such as the Lackawanna and Walton, are more responsive to good soil treatment than are the gray-yellow soils, such as the Canfield and Lordstown, though some examples of successful soil improvement of the last-named soils are evident in the county.

The improvement of pastures, especially on those areas where plowing is not easy, is receiving increased attention. The common grasses established include Rhode Island bent, Kentucky bluegrass, white clover, and others. Complete fertilizer should be frequently applied, a good mixture being a 14–20–14.[1] One recommendation given by State college representatives is a 16½–20–0 proprietary mixture as desirable for extremely rough pastures, to be applied at the rate of 100 pounds an acre.

Much care is taken in the preparation of land in growing cauliflower, such land probably being given more attention than is given in producing any other crop in the county. Most of the cauliflower is grown on selected areas of Walton silt loam, Tunkhannock gravelly loam, and well-drained Barbour soils. Land for the crop is preferably sod ground which, if possible, is plowed in the fall. In the spring

[1] Percentages, respectively, of nitrogen, phosphoric acid, and potash.

thorough preparation, consisting of harrowing and disking, is essential for best results. The land is limed to insure an alkaline reaction, an application of 2 tons of lime an acre being common. An acre application of as much as 15 loads of stable manure is made, if possible, and a heavy application of commercial fertilizer. Some growers use a 5–8–7 mixture. The plants, which are started in coldframes, are set about May 25 or June 1 and are carefully cultivated until the crop matures, between July 25 and August 1. Both early and late varieties are grown, the principal ones being Catskill Mountain and Snowball. The matured crop is marketed in crates and sent to New York markets by refrigerator freight. Returns from the crop may be as high as $1,000 an acre if the market is favorable and no setbacks are experienced in the way of plant diseases or unfavorable weather during the growing season. As returns in unfavorable seasons may be low or the crop may be a complete failure, the production of cauliflower is carried on by many farmers in connection with dairying or other farming industries.

Extensive areas of unimproved forested land in the county are not well suited for agricultural purposes. Some of this land is in State forest reserves, as in the southeastern part, and other areas are about to be taken over for public-park purposes. Table 6 gives the classification of the lands of the county as an index of their present condition.

TABLE 6.—*Agricultural classification of land in Delaware County, N. Y.*

Soil type	Approximate percentage	Class and description	Present condition and utilization
Lackawanna silt loam, Walton silt loam, Barbour silt loam, Barbour fine sandy loam, Barbour gravelly loam, alluvial-fan phase, Tioga silt loam, Tunkhannock gravelly loam, and Chenango silt loam.	35	A. Generally productive soils; good depth; moderately stony but arable; smooth surface, rolling to sharply sloping; good drainage; surface soil and subsoil favorable to retention of optimum moisture.	All in farms and a large part in cultivation. Some in permanent pasture and woodland.
Culvers silt loam, Canfield silt loam, Lordstown silt loam, and Barbour gravelly loam.	20	B. Medium, or moderate, natural productiveness; moderately stony but arable; good surface drainage, fair or somewhat deficient subsoil drainage; rolling, sloping, or hilly surface relief. Fair pasture land.	Perhaps more than half in cultivation, remainder in pasture; some so-called abandoned farms; some areas forested.
Norwich silt loam, Chippewa silt loam, Holly silty clay loam, peat, Colchester gravelly loam, Otisville gravelly loam, and alluvial soils, undifferentiated.	5	C. Land of limited agricultural value, in general with poor or deficient drainage, and some excessively drained.	Only the better areas suitable for cultivation. Land used mostly for pasture and to some extent forested.
Walton stony silt loam, Lackawanna stony silt loam, Culvers stony silt loam, and rough stony land.	40	D. Mainly nonagricultural land. Areas naturally too steep, rough, or stony to be used profitably in crop production.	Largely in forest, mostly hardwoods, some hemlock and pine. Selected locations more or less cleared and used for pasture.

SOILS AND CROPS

The region included in Delaware County is one in which the dairy industry is dominant, and the cropping system is adjusted accordingly. The natural features of the land surface have influenced the growth of this industry. The rugged and steep character of much of the county is not favorable to extensive grain or vegetable pro-

duction, and the growing of tree fruits has never found favor with the farmers who many years ago realized the suitability of the region for livestock production. Most of the land furnished good grazing, and extensive areas could be profitably used for pasture which, because of their steep or rugged relief and stony character, were not well suited for cultivation. The industry is further favored by an abundance of spring water and flowing streams. No large commercial industries have developed in Delaware County so that most of the villages have remained small, the population is predominantly rural, and the county is one of typical rural homesteads.

Almost all the soils of Delaware County have several characteristics in common. All the upland soils are comparatively heavy in texture, approximating silt loams, and all, with a few exceptions (mainly shallow soils overlying bedrock), have compact hardpan subsoils. The soils in general are more or less stony, and some are very stony. They have been derived from materials transported or modified to some extent by glaciers which moved over this region in past ages, although most of the upland soils bear a close relationship to the underlying rocks, the glacial material consisting mainly of locally derived material.

In the valleys are two classes of soils, one consisting of old alluvium, in part at least laid down by streams flowing from glacial ice, and the other, of more recently deposited alluvium. The old alluvium designated here as outwash deposits, in contrast to the upland soils, is in many places coarser or less uniform in texture, has a porous subsoil, and generally has a smaller content of large stones. The recent alluvium occupies the lowest-lying positions and consists of deposits of comparatively fine texture, with a few sandy variations in places.

Most of the upland soils have fair or good drainage, especially in the surface layers, but owing to the prevailingly hard subsoils thorough subdrainage is lacking in many of them, as in Canfield and Wellsboro silt loams. Lackawanna silt loam, although having a dense compact subsoil, shows much better internal drainage. Seepage, however, occurs in numerous locations on slopes and around heads of drainage ways in both the Lackawanna and Walton soils. Similar poorly drained areas occur within areas of the Culvers soils, and the soil in such places is recognized as Norwich silt loam. A soil occurring in similar positions in connection with the Canfield and Lordstown soils is identified as Chippewa silt loam.

All the soils of the county are decidedly acid in reaction in their upper layers, and in most places this holds true to a depth of several feet. Some of the gravelly deposits underlying the terrace soils bordering Susquehanna River are limy and alkaline at a depth ranging from 4 to 5 feet, but the great majority of the soils are acid, or sour, to a depth far below the penetration of plant roots.

In a broad way, the soils of the county may be classed in two general groups—those of somewhat red color and those of yellow or grayish-yellow color. Of these, the reddish soils greatly predominate and cover perhaps 80 per cent of the county. The soils of this group occupy the eastern, central, and southern parts of the county, and the soils of the yellow group are largely confined to the extreme northern and northwestern parts. The soils of the reddish group show some variation in the intensity of color. The more intensely red soils pre-

vail in the eastern and central parts of the county, whereas west and southwest of the area occupied by these soils the soils generally become less reddish. These paler soils may be considered a subdivision of the reddish group. They are a transitional development, as in the northern and northwestern parts of the county the reddish color largely disappears and a yellowish-gray group of soils prevails—the beginning of an extensive development of yellowish-gray soils occurring in several counties west and northwest of Delaware County.

The arrangement of the different areas of soils is governed largely by the surface relief of the county. The several deep-cut valleys, with their ramifying tributaries, in a dendritic pattern, control this arrangement. Ridge tops, being narrow, have a comparatively shallow mantle of soil material, and in a great many places the bedrock is exposed or has only a thin cover of soil. At the heads of valleys and along the lower valley slopes, the layer of unconsolidated material overlying the rock is thicker. The steeper valley sides also have thin deposits of soil and, being steep and rough, have little agricultural value. The main arrangement of soil areas occurs in belts, in general dependent on the width of the valleys, the steepness or gentleness of the slopes, and the width of the dividing ridges.

In the following pages, the soils of Delaware County are described in detail and their agricultural relationships are discussed; their location and distribution are shown on the accompanying soil map; and their acreage and proportionate extent are given in Table 7.

TABLE 7.—*Acreage and proportionate extent of the soils mapped in Delaware County, N. Y.*

Type of soil	Acres	Per cent	Type of soil	Acres	Per cent
Lackawanna silt loam	122,560	13.2	Barbour gravelly loam	18,496	2.0
Lackawanna stony silt loam	122,496	13.2	Barbour gravelly loam, alluvial-fan phase	4,288	.5
Walton silt loam	108,800	11.7	Canfield silt loam	23,808	2.6
Walton stony silt loam	9,024	1.0	Lordstown silt loam	46,720	5.0
Norwich silt loam	11,776	1.3	Chippewa silt loam	1,472	.2
Culvers silt loam	173,312	18.7	Chenango silt loam	4,096	.4
Culvers stony silt loam	102,336	11.0	Chenango silt loam, deep phase	704	.1
Wellsboro silt loam	4,672	.5	Chenango gravelly loam	896	.1
Tunkhannock gravelly loam	11,008	1.2	Otisville gravelly loam	4,864	.5
Colchester gravelly loam	11,584	1.2	Tioga silt loam	2,944	.3
Schoharie silt loam	384	.1	Holly silty clay loam	384	.1
Barbour silt loam	10,944	1.2	Alluvial soils, undifferentiated	2,304	.2
Barbour silt loam, high-bottom phase	3,904	.4	Peat	1,088	.1
Barbour fine sandy loam	2,752	.3	Rough stony land	116,608	12.6
Barbour fine sandy loam, high-bottom phase	3,136	.3	Total	927,360	

REDDISH UPLAND SOILS[2]

The best developed of the reddish soils are the Lackawanna and Walton silt loams. They may be considered the dominant soils of the county, and they support a large part of the agriculture in its best development. These soils are similar in their general color and structural characteristics, but Lackawanna silt loam occupies higher ridge positions, generally with moderate slopes, and is comparatively shallow over the underlying bedrock. Walton silt loam is much

[2] These soils are reddish rather than red, and the reddish color has been inherited from the reddish color of the underlying rocks. It is not the product of soil weathering during the course of soil development as is the red color in soils of the Southern States.

deeper, as it is developed from a valley-filling deposit. On this soil the slopes are much more prominent and surface drainage tends to be more free. Both soils have compact hardpan subsoils which prevent ready downward movement of rain water, and the drainage of surplus water is largely from the surface. Seepy spots of greater or less extent, which break up the continuity of the areas, occur on many of the slopes of both soils. Where of sufficient extent the seepy spots have been recognized and mapped as Norwich silt loam. Associated with Lackawanna silt loam is the related Lackawanna stony silt loam which includes the shallower areas on ridges and some of the stony sloping areas. Walton stony silt loam is also included in this group.

The characteristic reddish color of these soils places them in a comparatively dark-colored class. Their color is moderately effective in absorbing and retaining heat and in enabling the soil better to support a normal plant growth.

Lackawanna silt loam.—Lackawanna silt loam is the best-developed soil of the reddish upland soils group. It is much more intensely red than the other soils of the group. The cultivated surface material is dull reddish-brown or brownish-red friable silt loam which breaks up crumbly when plowed and worked. The coarser particles have a noticeably gritty or rough feel, but the finer particles provide sufficient body to render the soil fairly firm and smooth. The soil contains a fair quantity of organic matter as evidenced by the somewhat dull-brown cast. Beneath the cultivated layer is brownish-red or Indian-red crumbly silt loam which becomes more compact and less friable with depth. The reddish material below a depth of 18 or 20 inches becomes very dense and compact, assuming a hardpan condition in many places. This hardpan layer is difficult to penetrate with a pick, and the material chips or breaks away in hard brittle fragments. At a depth below 3 feet the material is somewhat more brittle and more easily penetrated. Intermixed with all the soil material are many fragments of reddish shale and sandstone, the sandstone fragments ranging in size from small angular gravel to large platy and slablike pieces. In cultivated fields, most of the stones sufficiently large to materially impede cultivation have been removed and used in building stone walls surrounding the fields.

Moisture does not readily soak into the subsoil, though some does filter through pore spaces. Most of the surplus rainfall drains from the surface and soon leaves the soil in a normal condition. Erosion is not a very serious problem, though on some of the slopes a little sheet erosion takes place, and occasionally torrential rains cause some washing.

Probably from 75 to 80 per cent of this soil is being cultivated. (Pl. 1, B.) The field crops consist of corn (chiefly for silage), oats, and hay, and such crops as buckwheat, barley, millet, and potatoes are grown to some extent. Land reserved for pasture generally comprises areas with a steep or uneven surface or the fields more remote from the farm buildings. The crops grown are fairly well adapted to the soil and produce good average yields.

Lackawanna stony silt loam.—Lackawanna stony silt loam differs from Lackawanna silt loam chiefly in its occurrence on much rougher surfaces, its greater stone content, and its slight depth to bedrock. Most of it is shallow, averaging less than 3 feet in thickness, and in

many places bedrock is exposed or nearly so. This soil, for the most part, occupies the crests of ridges, in some places extending a short distance down the slopes. Practically all of it lies higher, or somewhat higher, than the related Lackawanna silt loam.

The soil material, although reddish like the silt loam, in many places does not have a well-developed hardpan subsoil though this occurs in places where the soil is sufficiently deep. Shaly soil variations occur here and there, where shale rock is exposed or near the surface. In most places where the surface is comparatively smooth and the soil of sufficient depth, too many large rock and stone fragments occur to justify bringing these areas into cultivation. One area, located about 4 miles northeast of Delhi, is comparatively free of stone, and though the soil here does not average more than about 1 foot thick, the land is being cultivated with some success. (Pl. 1, A.) Some areas, once cultivated, are not now being used for cropping.

A large part of this soil, probably more than 80 per cent of the total area, supports a fair forest growth consisting largely of beech and maple, with a few oaks and pines. Other areas, which are more or less cleared, are used as pasture, though the grazing is not so good as that on arable soils of good depth. Some of the shaly variations, locally called "shell-rock land," produce fair yields of good-quality potatoes, and the value of such land for potatoes is recognized generally by farmers.

Walton silt loam.—Walton silt loam, owing to its characteristic position along valley slopes and in drumlin and drumloid formations, lies admirably as farm land and is favorable to rather full development as an agricultural soil. In places it extends up the slopes and grades into the higher-lying Lackawanna soils, and along the deeper valley slopes it lies below steep areas of rough stony land.

This soil closely resembles Lackawanna silt loam in color and profile development. The color, however, has a greater range, from the deeper Indian red of the Lackawanna to a paler red in areas associated with the Culvers soils. Being developed from glacial till as valley fill, the soil material is deep, ranging from 10 to more than 40 feet in thickness.

The surface soil in most places is dark reddish-brown rather gritty silt loam. When plowed and worked under proper moisture conditions the soil breaks up to a crumbly mellow structure. It contains a fair quantity of organic matter, as indicated by the somewhat darker color of the topmost part of the layer. Below plow depth the soil material becomes firmer but is still friable, and at a depth of 20 or 22 inches it changes to very dense or hardpanlike gritty dull-red or dull brownish-red silty loam.

Numerous reddish and brown sandstone and shale fragments occur throughout the soil material, ranging in size from small chips or gravellike pieces to fairly large platy and flaggy pieces. The larger of these have been removed from the fields and built into fences, many of which entirely surround the fields.

Good drainage is established. Although the subsoil is very hard and dense, some moisture filters into it and much is absorbed in the upper layers. Excess rain water drains from the surface readily, as the slope of the land is sufficient in most places. Some erosion or surface washing takes place on cultivated slopes but usually not to an alarming extent. Seepy places occur in numerous locations along slopes, where water issues from the hillsides and causes such places to

be poorly drained, breaking the continuity of the well-drained typical areas of the soil. Where such seepy spots are of sufficient extent they are outlined on the map as Norwich silt loam.

Nearly all of Walton silt loam is tillable or potentially tillable land, but a number of areas, most of them on upper slopes remote from farmsteads or surrounding areas of Norwich silt loam in smaller stream bottoms or other less desirable land, are reserved more or less permanently for pasture. Tillable land of this kind is chosen, as far as possible, from the smoother areas which usually occupy the lower valley positions where public roads and many of the farm buildings are established. Many farms containing areas of this soil also include other desirable soils, such as some of the terrace and stream-bottom soils.

This soil is well adapted to the crops grown in connection with dairy farming. The comparatively heavy texture of the soil, together with good drainage, makes the land well suited to such crops as corn, oats, forage crops, hay, and pasture grasses. It is not so well suited for a deep-rooted crop like alfalfa, owing to the dense compact subsoil, though with proper preparation this crop seems to succeed moderately well.

Walton stony silt loam.—Walton stony silt loam differs from Walton silt loam chiefly in the greater preponderance of stone and rock fragments strewn over the surface. The stones range in size from flat slabs to large blocks weighing a ton or more, and they render the land unsuitable for extensive improvement. Some areas of this soil support a mixed tree growth consisting mostly of hardwoods. Cleared areas furnish fair pasture, and profitable use is made of the land for this purpose.

Norwich silt loam.—Norwich silt loam is an upland soil characterized by its poor drainage. It is fairly well distributed throughout areas of the Lackawanna, Walton, and Culvers soils and occurs along wet seepage slopes or around small stream heads. Much of the land is cleared, but very little of it has been plowed.

The surface soil varies considerably from place to place, depending on drainage. On many wetter areas sufficient organic matter has accumulated to cause a mucky surface layer. Most of the areas have a hard dark ruddy-brown silty surface layer which is not very friable. With increase in depth the soil material becomes paler and is mottled with yellow, brown, rust brown, and gray, these colors becoming more pronounced with depth. The subsoil is very compact and more or less filled with embedded sandstone fragments in the finer material. Stones in various quantities are strewn over the surface and in most areas where the land is pastured numerous small hummocks are present.

The principal use made of Norwich silt loam is for pasture land. A variety of coarse reedy grasses, weeds, shrubs, and trees occupy some of the land and lessen its pasture value. White clover grows well, and on the better-drained areas bent grasses grow. The smoother areas are in some places used as hay meadows.

YELLOW UPLAND SOILS

As previously mentioned, west and south from the main body of Lackawanna and Walton soils in the county, a transitional soil belt is recognized. The color of the soil in this belt is less red and inclines

more toward yellow. In general, the surface relief is rougher and the land is more stony and less suited, economically, for farming. In fact, much of the steep rough stony land mapped is associated with soils of this group.

Soils of the Culvers series predominate over this belt. They are a little less desirable than the Lackawanna and Walton soils, because of the larger areas of rough land and their somewhat inferior productive capacity. These soils are of silt loam texture and have compact dense subsoils. Drainage is usually adequate, except in areas where soil gradations approach the characteristics of Norwich silt loam. Two types of the Culvers soils, the silt loam and the stony silt loam, are recognized and mapped in Delaware County. Culvers silt loam, having less stone content and smoother surface relief, has good average agricultural value, whereas Culvers stony silt loam, being very stony and in places rough and steep, has little value except for growing timber or, where cleared, for pasture.

Associated with the Culvers soils are several areas of Wellsboro silt loam. This, like the Walton soil, occupies valley-filling and slope positions but lacks the more pronounced red color of the Walton soil, and the materials of which it is composed are more variable. Most of the areas mapped are north of Walton toward Franklin. Others are scattered throughout the county. The characteristics of some areas of Canfield silt loam closely approach the characteristics of Wellsboro silt loam.

Culvers silt loam.—In its cultivated condition the surface soil of Culvers silt loam consists of dark ruddy-yellow or yellowish-red friable silt loam. The soil has a gritty feel caused by the angular small rock particles which are mixed with the finer-grained constituents. Below the surface layer, which extends to a depth of several inches, is light-red or yellowish-red moderately compact but friable silt loam. At a depth of 18 or 20 inches the soil material is more compact, and a few inches beneath the subsoil the material becomes fairly compact and dense and in many places is a hardpanlike silt loam. In many places, though not everywhere, the upper part of this hardpanlike layer is somewhat mottled with yellow, rust brown, or other variations in the light grayish-yellow silt loam. Small brown and gray sandstones and some larger ones are mixed with the soil material. On some of the divides the soil mantle is not more than 3 feet thick and in places rock outcrops occur.

This soil seems to have average productiveness for most crops. Where lime has been used, all the crops commonly grown give satisfactory yields, and clovers and other legumes thrive. In unlimed areas, as in some permanent pastures, the grasses show poor stands, and such plants as sorrel, fivefinger or cinquefoil, strawberry, wintergreen, ferns, and moss crowd out the more desirable grazing grasses. Many of the old pastures have scattered growths of red haw, briers, sweetfern, aspen, and other plants.

Many well-kept dairy farms are located on this soil or they include a large proportion of such land.

Culvers stony silt loam.—Culvers stony silt loam differs from Culvers silt loam chiefly in the large quantity of stone and large rocks present on the surface and embedded in the soil mass. This stony condition, together with much rough and uneven surface relief or a shallow soil mantle, render it impractical to bring the land into

a satisfactory cultivable condition. Some selected areas have been cleared of trees and are fairly profitable for use as pastures. By far the greater part of the land remains in forest, some of which, in the southern part of the county, lies within the State forest reserve. Deciduous trees, such as hard maple, white oak, beech, ironwood, cherry, and hemlock, predominate. Ferns or bracken are noticeable in the undergrowth.

Wellsboro silt loam.—The surface soil of Wellsboro silt loam consists of dull ruddy-yellow friable somewhat gritty silt loam. Below the topsoil the color becomes paler, approximately brownish yellow. At a depth ranging from 12 to 16 inches the material is gray or brownish-gray somewhat compact gritty silt loam, in some locations distinctly mottled with gray and yellow, and in some of the more favorably elevated positions, where drainage is more free, little or no mottling is present. Below a depth of 22 or 24 inches the subsoil is brownish-gray gritty silt loam compacted into a dense hardpan. In most places this material is mottled with reddish brown or streaked with faint variations of browner colors. Throughout the soil are different quantities of flat sandstone fragments, most of them gray, but a few are brown.

Most of the areas of this soil have good drainage, though some of the slopes include small seepy spots, especially along some of the small drainage ways.

Like Walton silt loam and much of Canfield silt loam, most of Wellsboro silt loam is good average farm land for the region, though it is seemingly a little inferior to the Walton soil. All the usual crops grow satisfactorily, and the soil responds well to careful management. Clover, timothy, and other hay grasses produce good stands. Pastures contain bent grasses, white clover, and other grasses.

REDDISH TERRACE AND STREAM-BOTTOM SOILS

Associated with the reddish upland soils are water-laid soil materials occupying valley floors. These are of two general classes—soils occupying low bench, or terrace, positions above overflow of the present streams and the lower-lying more recently deposited materials which are more or less subject to stream overflow. The soils on the terraces are somewhat more variable in their textural characteristics and in surface configuration than are those of the lower bottoms. The terrace soils typically are well drained, owing to the fact that they have gravelly loose porous subsoil layers. Most of them, however, are sufficiently retentive of moisture to be desirable farm land. The better soils are classed in the Tunkhannock series. Closely associated with the Tunkhannock soils are areas which have irregular and uneven surface relief, are variable in soil characteristics, and the soil material is generally so loose and porous as to be more or less droughty. Aside from the reddish color the soil characteristics are similar to those of the Otisville soils. This soil is classed in the Colchester series. All the soils of this group have an acid reaction throughout.

The terrace soils have certain advantages over the adjacent upland soils which have dense compact subsoils. They warm up early in the spring and drain readily after rains, thus enabling the land to be worked and crops planted earlier in the spring. In dry seasons,

crops sometimes suffer to some extent on areas in which the loose subsoils occur at a slight depth.

The Tunkhannock soils are good general-purpose soils, and satisfactory results are obtained with grains, hay, forage crops, and pasture. In a few locations these soils seem well adapted to cabbage, cauliflower, and root crops.

On many farms these terraces provide suitable sites for dwellings and farm buildings, and many farms include some land extending up the upland slopes as well as areas of stream-bottom land.

The recent-alluvial soils occupy the lowest positions. Being of comparatively recent deposition and in places still receiving soil materials during overflows, they are the youngest and least developed soils of the group. Most of these soils are comparatively fine textured, largely silt loams and loams. The surface relief, especially where the areas are wide, as along some of the larger streams, is smooth and good drainage prevails in most places. The soils in the narrower stream bottoms along the small upland streams are more variable in texture, surface configuration, and, to some extent, drainage.

The first-bottom soils of fair or good drainage are classed in the Barbour series. (Pl. 1, C.) They are very well adapted for growing corn, small grains, hay, and pasture. Corn perhaps is a little better suited to these soils than are oats or other small grains, because of the tendency of the stalks of small grains to be weak and lodge before maturity. Pasture grasses grow luxuriantly, and, as some of the bottoms are cut by stream channels, are irregular of surface, or are otherwise unsuited for cultivation, they are conveniently utilized for pasture.

Tunkhannock gravelly loam.—The surface soil of Tunkhannock gravelly loam consists of dark reddish-brown mellow loam or silty loam. It is underlain by light brownish-red somewhat firm but friable silty loam. In most places both the topsoil and upper subsoil layer contain moderate quantities of rounded brown gravel mixed with the finer materials. The subsoil below a depth of about 24 inches is a loose mixture of waterworn gravel, coarse sand, and fine sand, in places somewhat assorted in cross-bedded arrangement. Areas of this character comprise most of this soil as mapped. Some of the bodies along East Branch Delaware River have a much greater gravel content, constituting an extreme development of the type, but the quantity of gravel in these areas is in few places sufficient to interfere with their agricultural utilization.

The surface relief normally is nearly level or slightly undulating. A few areas are more rolling or uneven, sufficiently so to suggest a rolling phase of the type or an approach to Colchester gravelly loam. Some of the terrace fronts have rather abrupt and uneven slopes which are undesirable for cultivation.

Most of this soil occurs along the two branches of Delaware River and along the larger creeks. Some lies along Ouleout Creek and other tributaries of Susquehanna River where these streams lead from the red upland soils. The terrace level ranges from 20 to 30 feet above the lower stream bottoms.

Colchester gravelly loam.—Associated with Tunkhannock gravelly loam are numerous areas of irregular surface relief and variable soil characteristics which render the areas of low agricultural value. Such areas have been correlated as Colchester gravelly loam.

The surface soil of Colchester gravelly loam consists of an 8 to 12 inch layer of friable reddish-brown silty loam containing some sand, gravel, and other rounded brown sandstone pebbles. Below this, the material consists of beds of loose sand, gravel, and cobbles, variously stratified and cross-bedded, all the materials having more or less red color. Some of the rounded knolls are gravelly, practically from the surface downward.

Areas of this soil occur in narrow lateral belts along the valleys and within bends of the valleys. Some of the bodies occur as isolated knolls or kames in the valley bottoms, as in the vicinity of Hamden.

The somewhat broken uneven surface relief, together with the porous leachy character of the soil, renders most of the areas undesirable as farming land, but they serve as pasture ranges and most of the soil is so used. The better areas, which approach Tunkhannock gravelly loam in value, are cultivated with some success, especially in seasons of well-distributed rainfall.

Schoharie silt loam.—Schoharie silt loam occurs in only one body in the extreme eastern part of the county, where it forms an extension of a larger development in Schoharie County. It differs from most of the other soils of the county in that it is developed from old lacustrine deposits.

The surface soil of Schoharie silt loam to a depth of 6 or 8 inches is dull reddish-brown or light reddish-brown friable crumbly silt loam or silty clay loam which grades into ruddy-brown soil material of about the same texture. At a depth of 16 or 18 inches the material becomes firmly bedded silty clay, faintly mottled or streaked with gray, brown, or rust brown, and, below a depth ranging from 24 to 30 inches, is more or less laminated light-red silty clay.

In most places the upper soil layers are acid in reaction, but most areas show increasing alkalinity with depth and, at a depth ranging from 4 to 5 feet, the substratum is strongly alkaline. The comparatively heavy-textured surface soil is free of stones and gritty material and requires more care in handling to avoid puddling when wet than do most of the gritty upland soils. When too dry the broken soil fails to crumble readily.

The surface relief ranges from strongly undulating to somewhat rolling, and most of the land is comparatively smooth. A small included area is in reality a mixed phase of the typical soil. This included soil occurs as projections of the typical soil extending into an upland valley, and it grades into the higher upland soils. Areas of this phase were not separated on the map on account of their small extent. The typical soil is free of stone and rock fragments, but the small area of the mixed phase contains moderate quantities of small sandstones and some admixture of other upland soil materials strewn on the surface and scattered throughout the soil.

Probably more than 80 per cent of this soil is in improved farm land, and the general crops, which are used in connection with dairy farming, seem to give satisfactory returns. This is good grass and hay land and, as the substratum is alkaline in most places, alfalfa should thrive.

Barbour silt loam.—Barbour silt loam predominates on the broader first bottoms within the reddish upland soils region. It includes practically all the first bottoms along West Branch Delaware River and some of its larger tributaries but is less extensive along the east branch of this river.

The surface soil consists of dark brownish-red friable crumbly silt loam which below a depth of several inches assumes a little lighter red or Indian-red color, and here the structure is somewhat more compact. The lower part of the subsoil, at an average depth between 28 and 30 inches, consists of red sandy material which in most places changes below to looser sandy and gravelly deposits. The surface and upper soil layers are generally free of gravel, stone, or coarse material.

Barbour silt loam, high-bottom phase.—The greater part of Barbour silt loam lies in low places along the stream courses and is more or less subject to overflow. Some areas within bends of streams and some bordering the outer margins of the stream bottoms are above present overflow and are identified as a high-bottom phase. Although good drainage is established over most of the low-bottom areas, land of the high-bottom phase has generally freer run-off in addition to its freedom from overflow. The soil characteristics of the high-bottom phase are essentially the same as those of the typical soil.

Barbour fine sandy loam.—Small areas of Barbour fine sandy loam are associated with Barbour silt loam. Most of this fine sandy soil occurs along East Branch Delaware River, where, it seems, the water currents in laying down the sandy deposit must have been measurably swifter than were the waters depositing the finer silt loam. This soil in places may occupy the entire width of the flood plain, or it may occur as a marginal strip along the stream channel.

The surface soil is brown or dark-brown friable fine sandy loam. It grades into ruddy-brown moderately firm or compact fine sandy loam which easily breaks down into fine aggregates. Below a depth of 18 or 20 inches is a paler-colored or light ruddy-brown rather loose fine sandy loam or loamy fine sand, which, with depth, becomes loose ruddy fine sand, in many places stratified with coarser sand or gravel. The surface is generally free of gravel or other coarse materials, though in places some scattered rounded gravel occur. In the vicinity of Margaretville and Arkville, some of this soil has rather large quantities of rounded gravel on the surface and within the soil itself. Such areas are indicated on the map by gravel symbols.

Farming on Barbour fine sandy loam has developed to about the same extent as it has on the related Barbour silt loam. This is a good general-purpose soil, producing good stands of corn, small grains, hay, and pasture grasses. The surface is smooth enough to facilitate tillage operations, and the sandy texture makes cultivation easy. Probably 90 per cent of the soil may be considered improved land. Some areas cut by shifting stream channels and the parts more subject to overflow are reserved as permanent pasture.

Barbour fine sandy loam, high-bottom phase.—A number of areas, in all essential respects, like typical Barbour fine sandy loam, are elevated several feet, occupying low terrace positions, and have been correlated as a high-bottom phase. In position they resemble the Tunkhannock soils. They are well above all present stream overflow and in general have somewhat better drainage than the Tunkhannock soils. Areas of the phase lie along the lower course of East Branch Delaware River to and below Hancock and to some extent along Beaver Kill. This soil occurs in association with areas of Tunkhannock and Colchester soils, as well as in association with the typical

soil, in a number of detached narrow bodies along the landward sides of the valleys or within bends of the streams.

Two or three small areas, as those south of Cadosia and at Horton, have a sandy loam texture and because of this coarser texture are more porous and droughty. The coarser-textured areas have a low productive value and at present are not extensively used except for pasture.

Barbour gravelly loam.—Barbour gravelly loam is a first-bottom soil of variable character deposited along the smaller streams, and it is widely distributed in the region of reddish upland soils. It has not much importance as arable land, because it occurs as narrow belts along the streams which, in their meanderings, have cut the surface and left much of it unsuitable for cultivated crops. Probably 20 or 25 per cent of the land could be cultivated. Many depressions and marginal areas of this soil are poorly drained and are essentially alluvial soils, undifferentiated, and a few areas of this classification are included in areas of Barbour gravelly loam.

The surface soil of Barbour gravelly loam is reddish-brown gritty loam more or less mixed with angular or slightly rounded brown sandstone and shale gravel and a moderate quantity of flat platy stones of the same materials. This layer grades below into a paler-red gravelly loam subsoil. The content of stone varies considerably within short distances and may be entirely absent.

Some of the areas mapped, in which the soil material was washed largely from the paler-colored Culvers and Canfield soils, have a more yellow color. The soil in such areas approaches the characteristics of the Tioga soils.

Only the smoother areas of suitable size and reasonable freedom from overflow are cultivated. This is a strong soil for corn and hay crops. Pasture grasses thrive and running water is available. These conditions favor the use of most of the land as pasture. Many pastured areas are more or less clear of trees, but others have a fairly dense stand of elm, beech, poplar, willow, and other trees.

Barbour gravelly loam, alluvial-fan phase.—Barbour gravelly loam, alluvial-fan phase, occurs in many places along the larger valley bottoms in triangular-shaped areas at the mouths of the smaller tributary stream valleys, where overflow waters have spread overwash materials in the main valleys. They lie somewhat higher than the main valley bottoms and to some extent occupy a terracelike position. The slope is toward the trunk stream, and good drainage prevails. In general, the areas are not subject to overflow, as most of the stream channels are kept deepened and clear of obstructions.

The character of the soil is much like that of the typical soil but is more uniform in that larger areas are suited for agricultural use. Probably 90 per cent of the land of this phase is improved, and it is considered desirable farming land. Good yields of corn, hay, forage crops, and, in places, cauliflower are obtained. Many areas of this soil provide desirable sites for farm buildings.

GRAY-YELLOW SOILS

The soils of the gray-yellow group are identified by the gray sandstone and shale rock materials from which they originate. The deeper upland soils have dense hardpan subsoils and somewhat imperfect drainage. Like the other upland soils of the county they

have a rather large stone content, and over much of their area the surface relief ranges from sloping to steep. Agriculturally these soils are generally inferior to the reddish soils covering the larger part of the county. Many farms on these soils, once occupied and cultivated, are now abandoned, owing to their low productivity and unfavorable location.

As before stated, these soils occur in upland positions in the northern part of the county, mainly north of Charlotte Creek and Middle Brook, and in the region west and northwest of Trout Creek. Two soils, Canfield silt loam and Lordstown silt loam, occupy most of the areas. Canfield silt loam occupies moderately low valley positions, slopes, and a few low ridge or saddle positions. It has developed a hardpan subsoil and has a profile depth ranging from 10 to more than 20 feet over the underlying rock. In position and general depth, it resembles Walton silt loam.

Lordstown silt loam occupies higher-lying positions and usually caps the ridges and extends over some of the upper slopes. It differs further from Canfield silt loam in the absence or practical absence of a hardpan subsoil and in the slight depth of the soil material over the underlying rock. Most of the Lordstown soil has good drainage, whereas internal drainage of the Canfield soil is not thorough. In places where drainage is markedly deficient and the soil is somewhat darker, as in seepy places on slopes and around the heads of drainage ways, areas of both the Canfield and Lordstown soils are sufficiently different to be classed separately as Chippewa silt loam.

All these soils are strongly acid, and satisfactory crops are not long obtained without periodic applications of lime in addition to fertilizers. Grass seeding on unlimed land soon runs out, and weeds, such as goldenrod, daisies, cinquefoil, and sorrel, take the place of the grass. Many farms on these soils, once in cultivation, are, because of the difficulty in maintaining their productivity or because of inaccessibility, used only to a limited extent or are virtually abandoned. A larger percentage of unoccupied farms is on these soils than on any other agricultural soil group of the county.

Associated with these soils are several second-bottom and first-bottom soils which are developed from the same kinds of soil-forming materials.

Canfield silt loam.—The cultivated soil layer of Canfield silt loam consists of about 8 inches of grayish-brown or light-brown mellow smooth silt loam which overlies firmer-structured but friable brownish-yellow silt loam. At a depth of about 20 or 22 inches is a layer of brownish-yellow compact hardpanlike silt loam, mottled and stained with brown, rust yellow, and darker shades. On the surface and mixed through the soil material are various quantities of flat angular fragments of fine-grained sandstone and shale, but in most places these are not so plentiful as to interfere seriously with cultivation. All the soil, to a depth of several feet, is acid in reaction, and it is also naturally deficient in organic-matter content.

In a few scattered locations, especially along small drainage ways and in depressed situations, the soil is a little darker, the drainage is deficient, and a compact hardpan subsoil lies within a depth of 10 or 12 inches from the surface. Here, the surface soil is only moderately friable, and most of it is more or less mottled with gray and rust yellow.

This variation approximates Volusia silt loam and would have been so indicated on the map if the areas had been sufficiently extensive.

With intelligent management, the cultivated soil responds well and the tilth is readily improved. With the addition of manure, vegetable matter, and lime, good crops of corn, oats, and hay are obtained. Satisfactory results are had with clovers and other legumes where suitable quantities of lime are applied. This soil, when properly handled, supports good average dairy farms, and dairying or other livestock industries are best suited to maintain the productivity.

Lordstown silt loam.—The surface soil of Lordstown silt loam in cultivated areas consists of an 8-inch layer of light-brown or light yellowish-brown friable silt loam. This grades into brownish-yellow or yellow firm but friable silt loam, and below a depth of about 20 inches the material is dull yellowish-brown or light-brown more or less compact silt loam. The weathered soil is rather shallow, and in most places bedrock occurs at a depth ranging from 3 to 4 feet. In places the soil material for several inches over the rock approximates a hardpan. Areas in which the heavy subsoil lies deeper approach Canfield silt loam in character. All the soil layers contain more or less irregular-shaped gray sandstone fragments ranging from gravel size to ones weighing many pounds. On the crests of ridges and along the sides of some of the slopes, rock outcrops occur, and small areas may have only a thin soil mantle over the rock. Natural drainage is established, save in occasional sags and depressions of small extent where the surface run-off is sluggish.

Only a small proportion of this soil, perhaps 30 or 35 per cent, is cultivated. The cultivated areas occur where the slope is moderate and the soil of sufficient depth and easily accessible. Much of the soil on the higher narrower ridges is shallow, or the surface is marked by rock exposures or is uneven. Such areas support a forest growth or are used for pasture. Farms on this soil are solely of the dairy type, and some seem well maintained.

Chippewa silt loam.—Chippewa silt loam, occurring as it does in association with the Canfield and Lordstown soils, has been separated from those soils because of poor drainage. It occurs as scattered small areas in sags and depressions that receive drainage and seep waters from the higher levels.

The surface soil is dark-gray slightly friable silt loam or silty clay loam, in most places mottled with gray or brown. Below this is lighter-colored compact silty or clayey material mottled with light brown or bluish gray, which in many places is somewhat tough and plastic.

Scarcely any of this soil is cultivated. Where cleared it is used for pasture.

BROWN-YELLOW TERRACE AND STREAM-BOTTOM SOILS

The soils of this group are composed of glacial outwash and more recent alluvial materials. They are associated with the yellow upland soils, and like the upland soils, the soil-forming materials came largely from gray sandstones and shales. They have been reworked by glacial action.

In connection with the terrace soil formations, several texture and surface features are developed, which have a bearing on the agricul-

tural value of the soils. Most of these soils occur along the outer valley bottoms, and the surface level ranges from 20 to more than 30 feet above the present flood plains. The subsoils are of coarser texture than the surface soils, and they are well drained. These soils are identified in the Chenango series. They are fairly productive soils.

Associated with the Chenango soils are some areas of uneven or ridged surface relief or rounded knolls, with intervening depressions and soil of variable character. All of the soil material is more or less porous and open and is droughty. This soil has been correlated in the Otisville series.

Recent alluvium, in association with the terrace soils, has been deposited along the present streams, and additional soil deposits are made at each overflow. These soils normally have good drainage and are of good agricultural value. They are identified as Tioga soils.

Some first-bottom poorly drained spots located along the outer margins of the areas, which are compact and light colored, are classed as Holly silty clay loam. Because of its lack of desirable soil characteristics, this land is seldom cultivated but is reserved for pasture.

Chenango silt loam.—The cultivated surface soil of Chenango silt loam is light-brown or dull yellowish-brown friable silt loam. Below a depth of about 7 or 8 inches is yellow or light-yellow friable silt loam which becomes a little firmer with depth. This material changes at a depth ranging from 20 to 30 inches into yellowish-brown mixed coarse and medium sand and gravel, which is more or less stratified. A few scattered rounded gravel may occur on the surface and in the upper soil layers, but the material in many places is free of gravel.

The surface is in general flat or gently undulating. Many of the bench margins are sloping or somewhat broken and are not well suited to cultivation. The land is well drained, and although surface water does not drain freely from the flatter areas, excess soil moisture escapes easily into the porous subsoil.

Areas of this soil occur along Charlotte Creek and Susquehanna River, most of them in association with Chenango gravelly loam and Otisville gravelly loam. This is a fairly good agricultural soil, and from 70 to 75 per cent of its area is improved. It produces good yields of the common crops, corn, oats, and hay. Where maintained in proper fertility and limed, good stands of clover and alfalfa are produced.

Chenango silt loam, deep phase.—Chenango silt loam, deep phase, occurs only south of Sidney. It lies at a somewhat higher elevation than the typical soil, and the surface is a little more irregular. Soil of the phase has much the same character as the typical soil, except that the loose sandy and gravelly subsoil layer occurs at a greater depth, in most places below a depth of 3 feet. In places the porous layer seems not so well developed. This is good productive land, well drained, and withstands droughts well.

Chenango gravelly loam.—Chenango gravelly loam, associated with Chenango silt loam, occurs in about the same positions, but the surface is somewhat more uneven. It is distinguished from Chenango silt loam by the presence of a rather large quantity of rounded gravel of various sizes, and by the coarser texture of the finer soil material. Most of this soil is sufficiently open and porous to be very leachy and droughty, and much of it is not regularly cultivated. Some of the

better areas, which have a somewhat heavier texture in the upper layers, produce fairly good crops. Most of the land is used for pasture, though good grazing is difficult to maintain.

Otisville gravelly loam.—Otisville gravelly loam occurs in association with the Chenango soils and represents an extreme topographic condition which includes the more uneven hummocky second-bottom areas and the rougher margins of the Chenango soils. Rounded knolls and low eskerlike ridges are common. Characteristic developments are along lower Charlotte Creek in the vicinity of West Davenport, and a few small scattered areas are in other parts of the county where the soil material is not sufficiently red to be included with Colchester gravelly loam.

The surface layer consists of an 8-inch layer of dull yellowish-brown gritty loam containing a noticeable quantity of pebbles, gravel, and coarse sand. This material grades into a mixture of light-brown loam, sand, gravel, and small stones, variously stratified and cross-bedded, which extends to a depth of many feet.

The loose porous character of the material makes it very leachy and droughty, and for this reason and because of the uneven surface relief, the land has a low agricultural value. Only the better areas, which approach the Chenango soils in productivity, are cultivated. More than 90 per cent of the land is used for pasture or supports a fairly heavy tree growth, including oak, maple, and white pine.

Tioga silt loam.—Tioga silt loam is derived largely from materials washed from the uplands in the gray-yellow soil region of the county and similar soil regions of adjacent counties and deposited as first bottoms along Susquehanna River, Charlotte Creek, and Ouleout Creek.

The surface soil to a depth of about 8 inches is dull yellowish-brown friable crumbly silt loam which grades into light-brown or yellowish-brown silt loam or silty loam. This material, below a depth of about 20 inches, becomes more compact and less friable. In most places, between depths of 30 and 40 inches, the texture is more loamy and in many places includes rather loose fine sandy material, especially near the stream channels. In places a little gravel is scattered over the surface, but in general the soil is rather free of gravelly or coarse material. The soil is acid throughout all layers of the profile.

The areas mapped along Susquehanna River include a few small areas of Tioga fine sandy loam. These areas occur as fringes or occupy river bends where overflow waters have been comparatively swift. The principal developments are northeast of Sidney. The surface soil is mellow yellowish-brown fine sandy loam which grades into slightly more yellow fine sandy loam or loamy fine sand.

Tioga silt loam has good drainage, except in a few depressions and marginal areas where the soil resembles Holly silty clay loam or alluvial soils, undifferentiated.

Most of this soil, probably 90 per cent, is improved and used to some extent for cultivated crops. Its smooth surface facilitates the use of improved machinery in planting and harvesting. This is a good corn and grass soil, and good yields of these crops are obtained. Oats, millet, and clover are grown successfully.

Holly silty clay loam.—Holly silty clay loam is a light-colored poorly drained soil of small total extent and little agricultural importance. Only a few scattered areas are on the first bottoms, representative examples being those near Stilesville and north of Cannonsville.

The surface soil is light brownish-gray or gray heavy silt loam or silty clay loam. Below a depth of 10 or 12 inches is mottled or streaked compact dense silty clay with bluish-gray, yellow, and reddish-brown variations. Below a depth of 24 inches is dull-red gritty stony loam containing more or less coarse sand and rounded gravel.

Owing to the low-lying flat surface of this soil, surface waters do not drain readily, and in many places the surface soil remains waterlogged and wet for long periods. For this reason not much use is made of these areas except for pasture. Coarse wiry grasses are common, but white clover and some of the finer pasture grasses do well.

MISCELLANEOUS SOILS

Alluvial soils, undifferentiated.—This soil classification as recognized in Delaware County includes small scattered areas of very poorly drained land, mainly parts of first bottoms. Drainage is so poor that the surface is covered with water in wet seasons, and a marshy condition exists throughout the year. The texture of the soil varies greatly from place to place, and this feature, together with poor drainage, causes a soil condition rather than a definite soil. In places a mucky condition exists. Most of the areas of alluvial soils, undifferentiated, are in forest and brush, but some are cleared and used for such pasture as they afford.

Peat.—Peat consists of deposits of more or less raw organic matter in situations which have remained continuously wet for a long time. Evidently many of these areas were small lakes and ponds, which in the course of time have had the water displaced by an accumulation of plant remains.

Peat occurs in widely scattered small areas, mostly in the northern part of the county on the upland, but some areas are on the terraces and bottoms. Very few of the areas occupy more than 40 or 50 acres each.

Most of the peat consists of brown coarsely granular material retaining much of the fibrous structure of the woody materials from which it is largely formed. Some of the material is derived from grassy and sedgy vegetation, but the mass is mainly woody. Downward from the surface many remnants of trees, shrubs, twigs, sticks, and larger spongy woody fragments are interlaced and embedded in the finer material. Many of the deposits are many feet deep. Peat on some of the bottom land has some admixture of silty and gritty material left from overflow water. In places the surface layer is decomposed to a dark-brown spongy mucky consistence.

Nearly all the peat areas have a cover of trees, such as spruce, hemlock, white pine, elm, and swamp maple. Some of the larger areas are more or less open, with a low matted growth of rushes, ferns, heather, huckleberry, and a variety of water-loving plants.

Little agricultural use is made of peat areas, except a few more or less cleared areas which are included with adjoining pasture lands.

Rough stony land.—This classification includes lands mainly steep and otherwise too rough for normal agricultural use. It occurs in almost all parts of the county but more especially in the central and southwestern parts. It includes, for the most part, the steep valley sides which in many places extend upward rather sharply for

several hundred feet. The soil is very shallow, variable in character, and in color resembles the adjacent soils. Rock outcrops are common, and detached rocks of different sizes occur along many of the lower slopes. Here loamy colluvial soil has accumulated in many places. Practically all this land is forested with hard maple, oak, hemlock, some white pine, ironwood, elm, and other trees. A few more favorably situated areas have been cleared and are used for pasture.

SOILS AND THEIR INTERPRETATION

Delaware County is situated in the Allegheny Plateau uplift of eastern New York. It lies along the westerly slope of that rugged region known as the Catskill Mountains. The land of the county is well dissected, and elevations range from about 800 feet as a minimum valley elevation to more than 3,000 feet on the higher levels.

Considered as regards its soils, the county is a part of the glacial and loessial province, and all the soil materials have been transported to greater or less extent by movements of glacial ice in past ages. The mantle of soil-forming materials is comparatively thin, much thinner on the uplands than in the lower-lying valley lands. In respect to their development, the soils are included in the belt of brown forest soils, and their forested condition, together with the prevailing climatic influences, has favored the formation of podzolic characteristics.

Being in a forested region, the accumulation of organic matter has been slight on those soils sufficiently well drained to have been subjected to leaching for considerable time. Where poor drainage has prevailed, leaching and oxidation have been retarded, and more organic matter has been retained. Such areas, however, are small, scattered, and unimportant agriculturally.

The vegetation has been and continues to be composed largely of deciduous trees. Hard maple predominates, with some white oak, red oak, elm, hickory, ash, beech, and a variety of other species. White pine and hemlock originally were very plentiful, and small second-growth stands of these remain.

The soils of the county contain little or no calcareous materials in the form of lime carbonate. The climate is humid, with about 40 inches of annual rainfall, and the temperature is comparatively cool, with rather short summers and cold winters. These environmental conditions have favored leaching of iron, alumina, and humus, and the partial concentration of these materials at lower levels. Evidences of podzolization are not uniform in the county and in many places are not observable. Locations where these conditions are more common are at the medium or low elevations, where it seems that moisture has been abundant and evaporation moderate.

This, however, is a region of podzolized soils, even though podzolization is weakly developed in many places and entirely missing in others. The best podzol development would naturally occur on the somewhat flattened ridge tops and on the lighter material on the outwash terraces. Most of these areas are cleared. Where so much of the land is under sod, and the forests have been cut over in recent years, much of the evidence of podzolization has disappeared.

In virgin forests, numerous podzol developments were noted on ridge tops about 1,800 feet above sea level, in the Lackawanna and Culvers soils, and smaller developments were noticeable in the Lordstown and Canfield soils. All these soils have a silt loam texture. Of

these soils, the Culvers seems the most susceptible to podzolization. At lower elevations, the podzol surface soil appears mainly in the Chenango soils which contain much lighter material than the soils developed on the upland till.

The podzol layer developed under the forest duff in the reddish-brown soils has a purplish-gray or pinkish-gray color in contrast to the ash-gray layer occurring in the soils developed from gray rock material. The podzol layer averages between one-half and 1 inch thick, but it ranges from a mere film to 2 inches, depending usually on the thickness of organic accumulation on the surface. The brown layer, or orterde, is present in all places, even where the gray layer is missing. A complete profile description of a podzol soil under virgin forest conditions is given in this section under the description of Chenango silt loam.

Nearly all the soil-forming or parent material consists of coarse-grained brown sandstone and shale of the Catskill formation which, under the mechanical glacial action and later weathering of the material, has produced the larger part of the soils of the county. Small areas in the extreme northern and northwestern parts differ in that the soil-forming materials are similarly derived from finer-grained gray sandstone and shale. These rock materials being very largely siliceous, no calcareous or limy materials are contributed from this source. Glacial movements, however, have in places, as in some of the reworked and assorted materials of the terrace formations of the valleys, carried in some calcareous rock materials from locations some distance north of the county. Most of these deposits, presumably, were in small quantities and on becoming disintegrated have leached from the weathered zones of the soils, but in some places they occur as rock fragments and incrustations in the substratum.

The red or brown parent materials give rise to the red soils which predominate over most of the county.[3] The more distinctly red soils from upland glacial till material are identified as Lackawanna and Walton soils; those of less distinct red color are classed as Culvers and Wellsboro soils; and those from gray parent material are classed as Lordstown and Canfield soils. Red soils from water-laid materials are the Tunkhannock and Colchester soils on valley terraces and the Barbour soils on the recent flood plains. Valley terrace soils from the gray soil-forming materials are the Chenango and Otisville, and the Tioga soils occur on the recent flood plains.

With the exception of the Lordstown soils and Lackawanna stony silt loam, which are shallow, the upland soils may be considered imperfectly developed, as all have somewhat indurated hardpan subsoils and are not deeply oxidized. The terrace soils, the Tunkhannock and Chenango, both having comparatively open structure, have weathered more uniformly. Two soils, Norwich silt loam, in association with the Lackawanna and Culvers soils, and Chippewa silt loam, associated with Lordstown and Canfield silt loams, are imperfectly weathered because of poor drainage and are only partly developed. Holly silty clay loam, occurring on the first bottoms and likewise of deficient drainage, is only slightly developed. Alluvial soils, undifferentiated, and peat, both of small total extent, are more or less permanently wet and therefore undeveloped.

[3] The red color is due to rock color and not to oxidation in the process of soil development.

In the arrangement of the different soil groups, the deeper-red Lackawanna soils occupy high topographic positions as also do the Culvers soils. The Walton soils, being derived from valley-filling materials, everywhere occur at somewhat lower levels than do the Lackawanna and Culvers soils. In Delaware County, the Culvers soils are transitional soils, and in general they represent a gradation from the Lackawanna areas westward and northward to the gray-yellow soils of the Lordstown and Canfield soil group. The Lordstown soils occupy the higher positions and the Canfield soils lie generally lower and, like the Walton soils, occupy valley-filling positions. The valley terrace and recent alluvial soils, as heretofore indicated, occupy the lowest-lying positions.

The dominant soil profile of the uplands consists of a dull-brown or dark-brown friable silt loam surface soil, underlain by a lighter-colored well-oxidized layer which, in turn, is underlain by a more or less indurated or hardpan layer grading below into compact unweathered parent material.

The hardpan layer differs from place to place, among the various upland soils in which it occurs, in depth from the surface and to some extent in the degree of hardness. The hard layer, however, in most places is present at a depth ranging from 15 to 20 inches, lower in soils of good depth and better drainage, and higher where drainage is not so free. This condition evidently has been brought about as a soil development through the continued presence of a high ground-water level in the comparatively thin mantle of unconsolidated soil material.

The following profile description is given as representative of Lackawanna silt loam. The location is near Meredith, at an elevation of 2,200 feet, in undulating or rolling upland country, and in an area of essentially virgin soil.

(A) From 0 to 4 inches, dark brownish-red friable silt loam filled with grass and weed roots. The dark color is caused by accumulated humus. The material is acid in reaction.

(B_1) From 4 to 15 inches, brownish-red or Indian-red friable crumbly silt loam containing some small stones and rough pebbles.

(B_2) From 15 to 20 inches, increasingly compact, more distinctly red, and less friable silt loam, with a stone content similar to that in the B_1 layer.

(C_1) From 20 to 45 inches, very compact and hardpanlike Indian-red silty loam or silty clay loam. The material is so dense that it has to be chipped with a pick. Irregular fracture; vesicular; where earth is broken from pebbles and stones, the surfaces of the particles have a red-tinged glazed appearance.

(C_2) From 45 to 60 inches, continued dense and compact red material of about the same character as the material in the C_1 layer but somewhat more brittle and slightly more easily penetrated.

All horizons are decidedly acid in reaction. All are more or less stony, with variously shaped and sized brown sandstones packed firmly in the finer earth.

Related to the Lackawanna soils are the Walton soils. A profile of Walton silt loam as observed in a cultivated field in grass, at an elevation of 1,420 feet, is as follows:

(A) From 0 to 8 inches, dark reddish-brown friable and crumbly silt loam extending to about plow depth.

(B_1) From 8 to 18 inches, brownish-red friable silt loam.

(B_2) From 18 to 22 inches, dull brownish-red more compact but moderately friable silt loam.

(C_1) From 22 to 36 inches, compact dense hardpanlike gritty dull-brown loam containing various quantities of small sandstones. The material is mottled or streaked dull reddish brown and deeper brown, and it is vesicular in structure.

(C_2) From 36 to 55 inches, dull light-brown or grayish-brown sandy gritty till with a varying sandstone content.

The material in all horizons is distinctly acid in reaction.

As illustrative of the soils derived from gray fine-grained sandstone materials, the following profile of Canfield silt loam is given. Although the location apparently indicated a virgin condition, no podzolization was noticed. This soil occupied a slope at an elevation of about 1,400 feet.

(A) From 0 to 7 inches, dull brownish-yellow friable silt loam, in which the topmost one-half inch is a little darker, owing to the presence of grassy mold and moss. The layer contains some gray sandstone fragments.

(B_1) From 7 to 12 inches, brighter brownish-yellow or yellowish-brown firm but friable silt loam. This layer is stony.

(B_2) From 12 to 22 inches, light brownish-yellow moderately friable silt loam. The lower part of the layer is slightly stained with browner spots. The material is stony.

(C_1) From 22 to 40 inches, brownish-yellow compact hardpanlike silt loam, mottled and stained with brown, rust yellow, and veins of black. The material is more or less vesicular and stony.

(C_2) From 40 to 75 inches, a dense hardpan consisting of dull brownish-yellow silt loam, with dull mottlings of brown, bluish gray, and flecks of black. This layer has a liberal sandstone content. A few brown sandstones, rounded quartzite bowlders, and chert pebbles occur throughout the hardpan.

The following profile of Chenango silt loam, deep phase, represents soil conditions where drainage is comparatively free and podzolization is developed. This soil occupies an area lying at an elevation of 1,120 feet and forested with hemlock, beech, some maple, and formerly chestnut.

(A_0) From 0 to 4 inches, very dark grayish-brown turfy leaf mold bound together with shrub and tree roots.

(A_1) From 4 to 5 inches, light-gray mealy leached silt or silt loam.

(B_1) From 5 to 5½ inches, rich-brown or coffee-brown compact silt loam.

(B_2) From 5½ to 16 inches, brownish-yellow friable silt loam.

(B_3) From 16 to 30 inches, dull brownish-yellow moderately compact and friable mealy silt loam containing scattered small gray sandstone fragments.

(B_4) From 30 to 42 inches, brown or dull-brown compact rather brittle silt loam faintly stained with duller brown and grayish brown.

(C_1) From 42 to 60 inches, a mixture of different grades of sands, rounded gravel, and cobbles of gray, and some brown sandstone. The material is loose and porous.

The material of all horizons is distinctly acid in reaction.

SUMMARY

Delaware County is in the southeastern part of New York. The land area is 1,449 square miles, or 927,360 acres.

The surface features are marked by a thoroughly dissected plain with a southwestward slope, the drainage of which is carried by the two headwater forks of Delaware River, and in the northern part by Susquehanna River.

The population of the county in 1930 as reported by the Federal census is 41,163, 91.5 per cent of which is rural.

Most of the original forest consisted of hardwoods, with fairly large stands of white pine and hemlock. Maple is the predominant

species at present. Nearly half the county remains in forest. Most of the forested land is too rough for profitable cultivation.

Good railway service and fairly ample surfaced highways are provided.

The climate is characterized by mild, pleasant summers and moderately long, cold winters. The annual mean precipitation, including snowfall, is about 40 inches. The frost-free season is about four months long.

Permanent settlements were made immediately following the American Revolution, the settlers coming from New England and older settled parts of New York State. For many years farming was of a general type, but in the last 40 years dairying has developed into the major industry, and practically the whole farm economy is planned to support this industry. Most of the milk is shipped as market milk to New York, though some is manufactured into several minor products.

The soils of the county have been correlated in 16 series, including 22 different soil types and 4 phases of types, in addition to 3 miscellaneous land classifications. The upland soils range from rolling to hilly. All have hardpan subsoils, most of them have fair or good natural drainage, and all react acid to a depth of several feet. The texture of the surface soils is predominantly silt loam, and all the soils are more or less stony. Probably more than 80 per cent of the upland soils are red or tinged with red. Lackawanna, Culvers, and Walton silt loams are the most important agricultural soils. The Lackawanna soil has a deep Indian-red color, and the Culvers soil paler red or yellowish red. Both occupy the higher-lying positions in the county and are comparatively shallow over bedrock. The Walton soil occupies valley-filling positions and, like the Lackawanna, has a distinct red color. All these soils are productive under good management and support good pastures.

Smaller areas of Canfield and Wellsboro silt loams and Lordstown silt loam in the northern and northwestern parts of the county are grayish yellow and are inferior in agricultural value to the red soils.

Red stream-bottom soils, including Barbour silt loam, Barbour loam, and Barbour fine sandy loam, and Tunkhannock gravelly loam on the second bottoms are well-improved and productive soils. Smaller areas of a brown or yellowish-brown first-bottom soil, Tioga silt loam, and Chenango silt loam on the second bottoms are also good agricultural soils. Rough stony land and the rather large areas of Lackawanna and Culvers stony silt loams are too rough and stony to be of much agricultural value, and they remain mostly in forest. Smaller areas of Norwich silt loam and Chippewa silt loam, as well as alluvial soils, undifferentiated, peat, and Holly silty clay loam, have poor drainage and are pastured or remain in forest. Colchester gravelly loam, of red color, and Otisville gravelly loam, of brownish-yellow color, both composed of glacial outwash materials, are porous, leachy, and droughty, have irregular surface relief, and are of little agricultural value.

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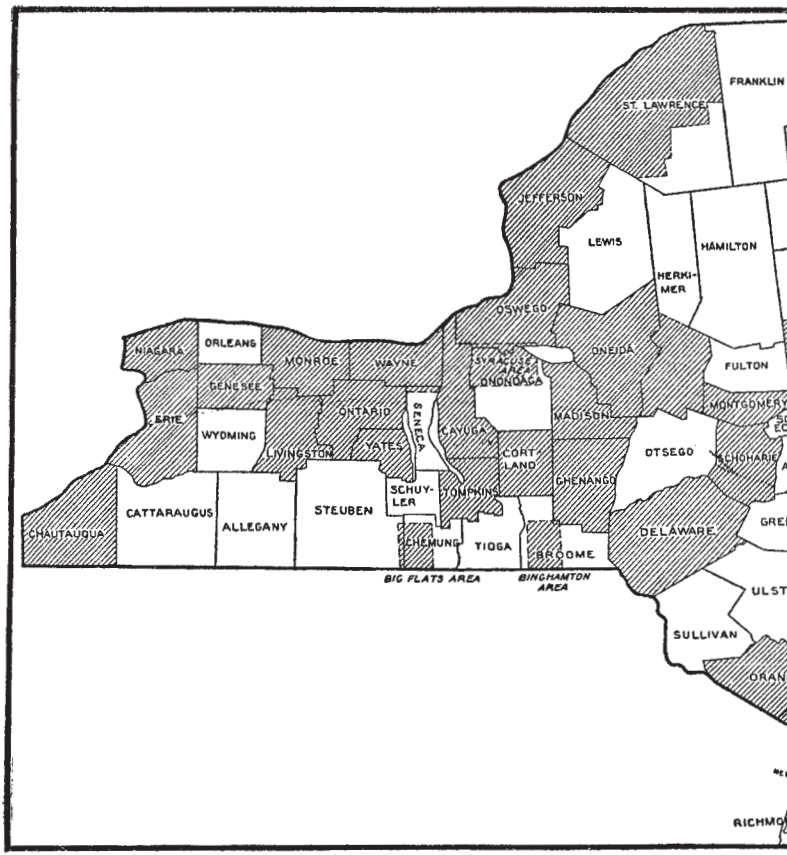
There shall be printed as soon as the manuscript can be prepared with the necessary maps and illustrations to accompany it a report on each soil area surveyed by the Bureau of Chemistry and Soils, Department of Agriculture, in the form of advance sheets bound in paper covers, of which not more than two hundred and fifty copies shall be for the use of each Senator from the State and not more than one thousand copies for the use of each Representative for the congressional district or districts in which a survey is made, the actual number to be determined on inquiry by the Secretary of Agriculture made to the aforesaid Senators and Representatives, and as many copies for the use of the Department of Agriculture as in the judgment of the Secretary of Agriculture are deemed necessary.



Areas surveyed in New York, shown by shadi

Detailed surveys shown by northeast-southwest hatching

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CURTIS F. MARBUT, IN CHARGE SOIL SURVEY

SOIL MAP
DELAWARE COUNTY
NEW YORK

CORNELL UNIVERSITY AGRICULTURAL EXPERIMENT STATION
CORNELIUS BETTEN, ACTING DEAN AND DIRECTOR
T. L. LYON, HEAD, DEPARTMENT OF AGRONOMY

Inspected by W. J. Latimer.
Soils surveyed by Clarence Lounsbury, U. S. Department of Agriculture, in charge, and P. D. Beers, F. B. Howe, E. E. Watts, C. S. Pearson, and C. H. Diebold, Cornell University Agricultural Experiment Station

BASE MAP FROM
U. S. GEOLOGICAL SURVEY SHEETS

Scale [illegible]
Contour interval 20 feet.
Datum is mean sea level.

Field Operations
Bureau of Chemistry and Soils
1930